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Spectral Parameterization of Sound Wave Scattering from a Random Ocean Bottom and Acoustic Reconnaissance Data Analysis

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6. AUTHOR(S)
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11. SUPPLEMENTARY NOTES
The theorectial formalism of the Scattering Correlation Coefficient (SCC) was completed and the result has been published in Journal of Acoustical Society of America, Tang and Frisk, 92 (5), 2792-2799 (1992).

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited

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13. ABSTRACT (Maximum 200 words)

The objectives of the grant was to develop a new concept called the Scattering Correlation Coefficient (SCC) to characterize low-frequency bottom scattering and to analyze some of the 1991 ARSRP reconnaissance experiment data obtained in the sediment pond.

In the data analysis part of our work, we concentrated on understanding the data set near a sediment pond area. Because the environment surrounding this pond was very complicated, and the acoustic source/receiver array responses have complicated structures, we proceeded by isolating individual effects and comparing the scattered signals due to the sediment with those due to rocky areas at exactly the same incident and scattering angles. We accomplished this by using forward- and backward-looking beam signals with the same beam angles. Pings 198 and 199 from the ARSRP 1991 reconnaissance cruise were extensively examined.

For the modeling part, we have introduced a spectral parameterization which is suitable for describing acoustic scattering from a random ocean bottom. Unlike the scattering cross section, which is defined in the spatial domain, the SCC, is defined in the wavenumber domain.

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May 6, 1996

Dr. Jeffrey Simmen
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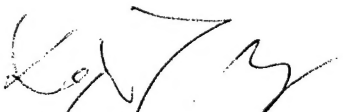
Dear Jeff,

Enclosed please find the final report of the Grant "Spectral parameterization of sound wave scattering from a random ocean bottom and acoustic reconnaissance data analysis," Grant N00014-92-J-1432.

Sincerely,



Dajun Tang

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Final Technical Report
Spectral Parameterization of Sound Wave Scattering from a Random Ocean Bottom and Acoustic Reconnaissance Data Analysis
Grant N00014-92-J-1432

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The objectives of the grant was to develop a new concept called the Scattering Correlation Coefficient (SCC) to characterize low-frequency bottom scattering and to analyze some of the 1991 ARSRP reconnaissance experiment data obtained in the sediment pond. This research was started under the background that bottom scattering had been receiving increased attention. The ONR sponsored ARSRP reconnaissance experiment produced large amounts of bottom scattering data near the Mid-Atlantic Ridge area, where the bottom features range from mid-ocean ridges to sediment ponds. These data therefore provided an opportunity to investigate the scattering characteristics of different bottom types. In conjunction with the data analysis, the issue of quantifying the bottom scattering process needed to be addressed. The conventional method of characterizing bottom scattering is based on the classical concept of scattering cross section. This concept is typically developed in the context of wave propagation in a medium that is homogeneous except for a small region (the scattering region) where the physical properties, e.g., sound speed or density in acoustics or refractive index in electromagnetics, are different from those in the surrounding medium. In underwater acoustics, a quantity which is frequently used to parameterize volume scattering is an outgrowth of this classical framework and is defined as the volume scattering cross section. This parameter was inadequate to quantify low-frequency bottom scattering because of multipath and refraction effects. Therefore, a new method to quantify this interaction was required.

In the data analysis part of our work, we concentrated on understanding the data set near a sediment pond area. Because the environment surrounding this pond was very complicated, and the acoustic source/receiver array responses have complicated structures, we proceeded by isolating individual effects and comparing the scattered signals due to the sediment with those due to rocky areas at exactly the same incident and scattering angles. We accomplished this by using forward- and backward-looking beam signals with the same beam angles. Pings 198 and 199 from the ARSRP 1991 reconnaissance cruise were extensively examined.
For the modeling part, we have introduced a spectral parameterization which is suitable for describing acoustic scattering from a random ocean bottom. Unlike the

scattering cross section, which is defined in the spatial domain, the SCC is defined in the wavenumber domain. Assume that scatterers are randomly distributed on and beneath the water/bottom interface, both the incident wave and scattered waves are expanded as plane wave superpositions. The theoretical formalism of the Scattering Correlation Coefficient (SCC) was completed and the result has been published in a paper (Tang and Frisk, "Spectral parameterization of scattering from a random ocean bottom," J. Acoust. Soc. Am., **92** (5), 2792-2799, 1992).

The funds were spent according to the budget on salary and travels, plus the purchase of a workstation to support the data analysis.